PATENT SPECIFICATION

DRAWINGS ATTACHED

910,250

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COMPLETE SPECIFICATION

Noise Suppression Device for Turbo-jet Engines

We, VICKERS - ARMSTRONGS (AIRCRAFT) LIMITED, a British Company, of Vickers House, Broadway, Westminster, London, S.W.1, and JOHN ANTHONY HAY, a British Subject, of Black Gable, 35, Rowtown, Addlestone, Surrey, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

With the object of reducing the volume of noise generated by the efflux of a turbo-jet engine of an aeroplane, the present invention proposes to provide means for decreasing the effective jet velocity, by entraining with the jet efflux additional air. For this purpose there are mounted in the efflux at positions close to and downstream of the jet nozzle a plurality of vanes the effect of which will be to induce the admixture of additional air with the jet gases, each such vane having a vertex extending upstream, whereby the effective velocity of the jet is diminished and the volume of noise emanating therefrom is reduced to a tolerable level.

The said vanes, which are conveniently disposed in spaced relationship equiangularly about the axis of the jet efflux, may be mounted upon carriers supported upon the engine nacelle or an adjacent fixed part of the aircraft structure. Mechanism may be provided for moving said carrier so that the assembly of vanes may be extended into or retracted from their operative position during flight when noise reduction is not required.

The shape of the vanes is arbitrary. They may be rectangular or triangular, with possible intermediate shapes having curved or straight marginal edges. In the case of a triangular shape, the greater span is near the downstream edge, and the span decreases towards a pointed vertex.

It is desirable that the vanes be mounted so that their planes extended upstream, are inclined rearwardly at an angle of between 3° and 30° to the axis of the jet efflux.

The manner in which this invention may be carried into effect is hereinafter described in greater detail with reference to the accompanying diagrammatic drawings. In said drawings Fig. 1 is a longitudinal section of the after part of a turbo-jet engine having noise suppressing apparatus constructed and operating in accordance with the invention, and Fig. 2 is a rear elevation thereof. Figs. 3, 4, 5 and 6 are diagrams respectively illustrating the portions of the several parts of the apparatus (a) when the vanes are retracted, (b) at an intermediate stage in the operation of extending the vanes, (c) when the vanes occupy their operative position, and (d) at an intermediate stage in the operation of retracting the vanes.

In the drawings, the reference numeral 10 designates the after end of the engine efflux jet-tube and 11, 11, 11, 11, are four housings mounted on the exterior of the tube 10 at equiangularly spaced positions thereon, as shown in Fig. 2. Each such housing 11 contains two fluid-pressure jacks 12, and 13 disposed in side-by-side parallel relationship, said jacks being mounted on a common support 14 which is pivoted to the fixed structure member 15 at 16.

Each jack 12 contains a ram 121 the rod 22 of which is pivotally attached at its outer extremity to a carrier 123 which is arranged to slide longitudinally upon two spaced stops 124, 125 which cooperate with a slot 126, the stop 124 serving to determine the retracted position of the carrier and the stop 125 serving to determine the extended position thereof. At its outer extremity each carrier 123 there is pivotally mounted at 127 a vane 17 which is of triangular shape having a vertex 172 extending upstream and its base or greater span at the downstream end. The vertex 172 is pointed or slightly rounded.

Each jack 13 contains a ram 131 the rod 132 of which extends through fixed guide

bracket 133. Aft of the bracket 133 the rod 132 is connected pivotally at 134 to a link 135 the opposite end of which is pivoted at 136 to an arm 173 fixed to the vane 17.

To extend the vanes 17 from the retracted position shown in Fig. 3, fluid pressure in the pipe-lines 18, 19 is applied to both jacks 12 and 13, with the result that the rams are forced outwardly, and the vane 17 is extended to the position shown in Fig. 4. The pressure in the line 19 exceeds that in the line 18 and thus the vanes are prevented from being deflected before they have cleared the ends of the housings 11. During this stage the ports 20, 21 are open to exhaust. The vanes 17 still occupy positions in which they are respectively substantially parallel to their carriers 123, and to achieve their further movement into the inclined operative positions shown in Figs. 1, 2 and 5, pressure in the pipe-line 19 is relaxed by opening a relief valve 22, and pressure is applied to the jack 13 through the port 21, the jack 12 being held in the extended condition. To restore the vanes to the housed position, the port 18 is opened to exhaust, the valve 22 remains open, and pressure is applied to both jacks through the ports 20 and 21. The vanes first resume their inoperative positions, as shown in Fig. 6, whereafter the whole assembly is retracted to the position shown in Fig. 3.

The mounting of the vanes is preferably such that in the operative position they are inclined rearwardly at an angle between 3° and 30° to the axis of the jet efflux, indicated by the line X — — — Y in Fig. 1.

The effect of extending the vanes 17 to the position shown in Figs. 1, 2 and 5 is to cause additional air to be entrained with the jet efflux gases. The effective jet velocity is thereby diminished, in consequence of which the volume of noise generated by the jet efflux is substantially reduced.

WHAT WE CLAIM IS:—

1. Means for reducing the noise of the efflux of a turbo-jet aeroplane, wherein there are mounted in the efflux at positions close to and downstream of the jet nozzle a plurality of vanes the effect of which will be to induce the admixture of additional air with the jet gases, each such vane having a vertex extending upstream.

2. Means as claimed in Claim 1, wherein the vanes are disposed in equiangularly spaced relationship about the jet efflux axis, being mounted on carriers supported by the engine nacelle or adjacent fixed aircraft structure, said carriers being capable of extension into or retraction from the operative position during flight.

3. Means as claimed in Claim 2, wherein there are provided in respect of each vane a pair of fluid-pressure jacks, the ram of one such jack being connected to a carrier slidably mounted on said fixed structure and supporting at its outer extremity a pivotally mounted vane, the ram of the other jack being linked to an arm on said vane, the arrangement being such that the operation of the jacks is effective to extend the vane into or retract it from the operative position.

4. Means as claimed in Claim 3, wherein the said vane and extension mechanism are enclosed when retracted in a fixed housing on the outer wall of the jet tube.

5. Means as claimed in Claim 4, wherein on the extension stroke the carrier is moved to the fully extended position before the vane is deflected.

6. Means as claimed in Claim 4, wherein on the retraction stroke the vane is moved to its housed position relative to the carrier before the latter is withdrawn into the housing.

7. The improved noise-suppression means for the efflux of a turbo-jet engine, constructed, arranged and operating substantially as herein described with reference to the accompanying drawings.

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910,250 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale.
SHEETS 1 & 2

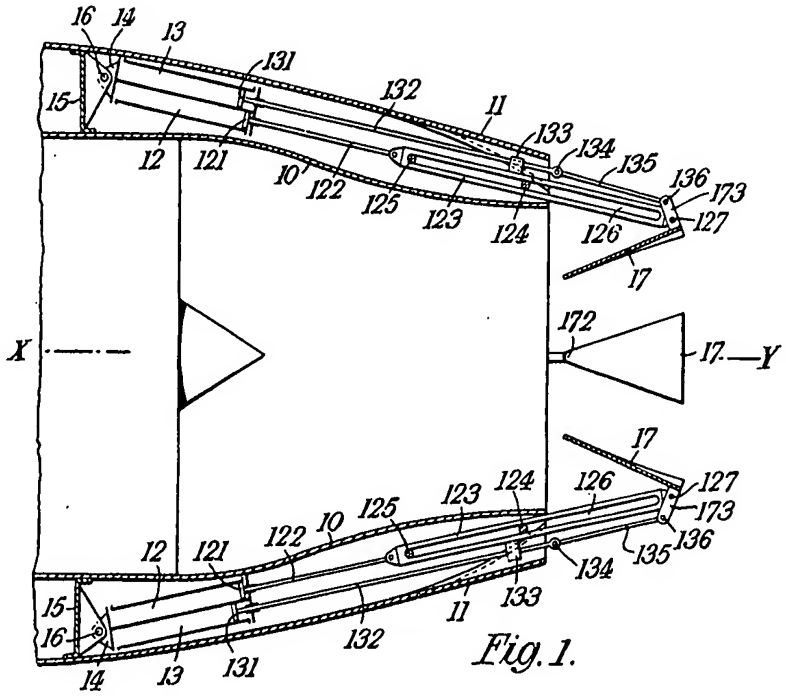

Fig. 1.

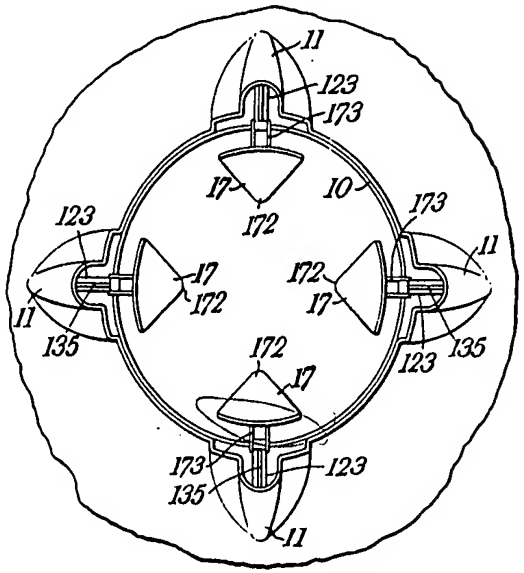

Fig. 2.

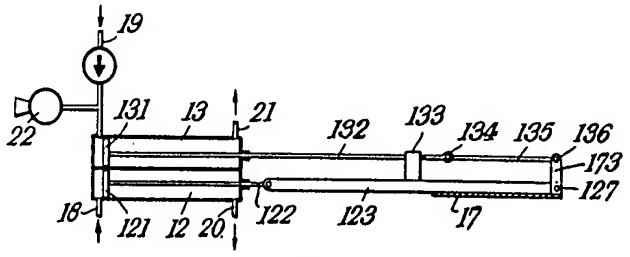

Fig. 3.

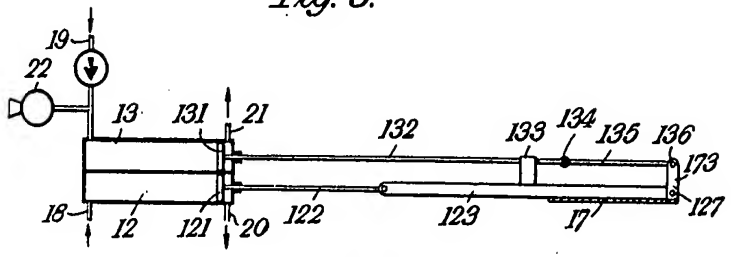

Fig. 4.

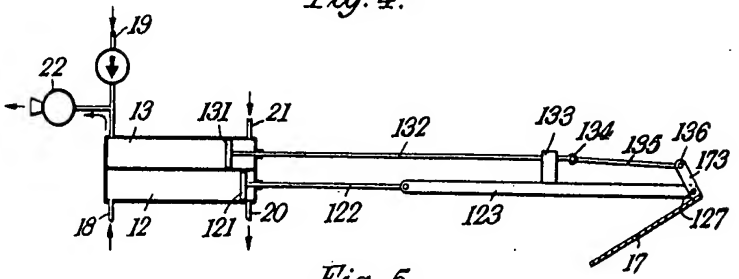

Fig. 5.

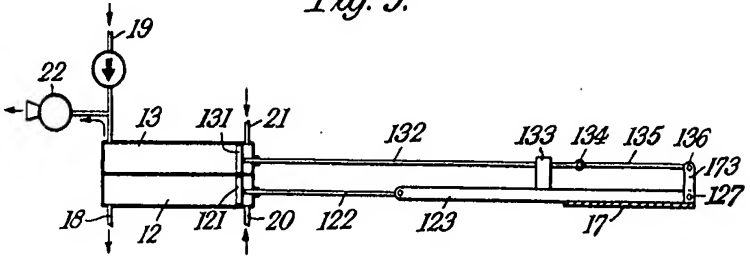

Fig. 6.